

# **TH08R Spring Control System**

## **User's Manual**

## Foreword

TH08R Spring Control System is a multi-functional, economical embedded numerical control system developed by Adtech (Shenzhen) Technology Co., Ltd. for 2-4 axis universal machine, spring compression machine, and spring torsion machine.

Instructions and reading conventions about this manual:

Before using the CNC system for the first time, please read this manual carefully in order to better play the system functions.

Terms and reading conventions in this manual:

“Note” indicates that the operator should be careful when performing operations or settings, or else it may cause operation failure or an action can't be executed.

## Precautions

### ◆ Transport and storage

- ☞ Do not stack product package more than six layers;
- ☞ Do not climb, stand on or place heavy stuff on the product package;
- ☞ Do not pull the cable still connecting with machine to move product.
- ☞ Forbid impact and scratch on the panel and display;
- ☞ Prevent the product package from humidity, sun exposure, and rain.

### ◆ Open-box inspection

- ☞ Open the package to confirm the product to be purchased by you;
- ☞ Check damages situation after transportation;
- ☞ Confirm the integrity of parts comparing with the parts list or damages situation;
- ☞ Contact our company promptly for discrepant models, shortage accessories, or transport damages.

### ◆ Wiring

- ☞ Ensure the persons involved into wiring and inspecting are specialized staff;
- ☞ Guarantee the product is grounded with less than 4Ω grounding resistance. Do not use neutral line (N) to substitute earth wire.
- ☞ Ensure grounding to be correct and solid, in order to avoid product failures or unexpected consequences;
- ☞ Connect the surge absorption diodes to the product in the required direction, otherwise, the product will be damaged;
- ☞ Ensure the power switch is OFF before inserting or removing plug, or disassembling chassis.

### ◆ Overhauling

- ☞ Ensure the power is OFF before overhauling or components replacement;
- ☞ Make sure to check failures after short circuit or overloading, and then restart the machine after troubleshooting
- ☞ Do not allow to frequently connect and disconnect the power, and at least one minute interval between power-on and power-off.

### ◆ Miscellaneous

- ☞ Do not open housing without permission;
- ☞ Keep power OFF if not in use for a long time;
- ☞ Pay close attention to keep dust and ferrous powder away from control;
- ☞ Fix freewheel diode on relay coil in parallel if non-solid state relay is used as output relay. Check whether power supply meets the requirement to ensure not burning the control;
- ☞ Install cooling fan if processing field is in high temperature, due to close relationship between service life of the control and environmental temperature. Keep proper operative temperature range for the control: 0°C ~ 60°C;
- ☞ Avoid using the product in the overheating, humid, dusty, or corrosive environments;
- ☞ Add rubber rails as cushion on the place with strong vibration.

### ◆ Maintenance

Please implement routine inspection and regular check upon the following items, under the general usage conditions (i.e. environmental condition: daily average 30°C, load rate: 80%, and operating rate: 12 hours/ day)

Table1 Equipment checklist

<p>Routine Inspection</p>	<p>Routine</p>	<ul style="list-style-type: none"> <li>● Confirm environmental temperature, humidity, dust, or foreign objects.</li> <li>● Confirm abnormal vibration and noise;</li> <li>● Check whether vents are blocked by yarn etc.</li> </ul>
<p>Regular Check</p>	<p>One year</p>	<ul style="list-style-type: none"> <li>● Check whether solid components are loose</li> <li>● Confirm whether terminal block is damaged</li> </ul>

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## Chapter 1 Technical Features of the System

### 1.1 Technical parameters

The technical parameters of the system are shown in Table 1:

Table 1 System Technical Parameters

Function	Name		Specifications
Control axis	Number of control axes		2-4 axis linear interpolation (TH08R)
Input command	Minimum setting unit	Length	0.01 mm
		Angle	0.1°
	Minimum movement unit	Length	0.01 mm
		Angle	0.1°
	Maximum command value	Length	79999.99 mm
		Angle	360.0°
Manual	Hand uniaxial		Yes
	Hand processing		Yes
Interpolation	Linear interpolation		M instruction
Operating mode	Automatic, single, manual, edit		Yes
Debugging function	Handwheel test processing, test knob processing		Yes
Safety function	Emergency stop		Yes
Program storage	Program memory, storage number of programs		Save up to 999 processing files, each has 200 lines of program
Program editing	Program editing		Delete, delete all, insert, save, cancel
Display	800*600 dot matrix, 10.4-inch LCD		Yes
	Position display, program editing, message alert, probe / cylinder state, remaining time, production speed, output, I/O diagnosis interface, parameter setting interface, key detection interface, time setting interface		Yes

### 1.2 System functions

The system uses Samsung 2440 processor and FPGA to provide higher processing efficiency, 10.4-inch color LCD, Chinese and English interfaces for different countries, 2-4 axis servo control; supports axis mode, axis name is optional, and can be applied a variety of systems such as universal machine, spring compression machine and spring torsion machine. Supports 8 groups of probe input and 8 groups of cylinder output, supports wire kinking and breaking alarm detection of wire feeding frame, dual debugging processing functions of hand wheel trial processing and test process, features intuitive, simple and easy programming, comprehensive and complete information prompts, supports USB function for easy software upgrade, and supports USB and RS232 communications, which facilitate connection with computers.

## Chapter 2 Installation and Electrical Connections

### 2.1 Physical map and installation layout

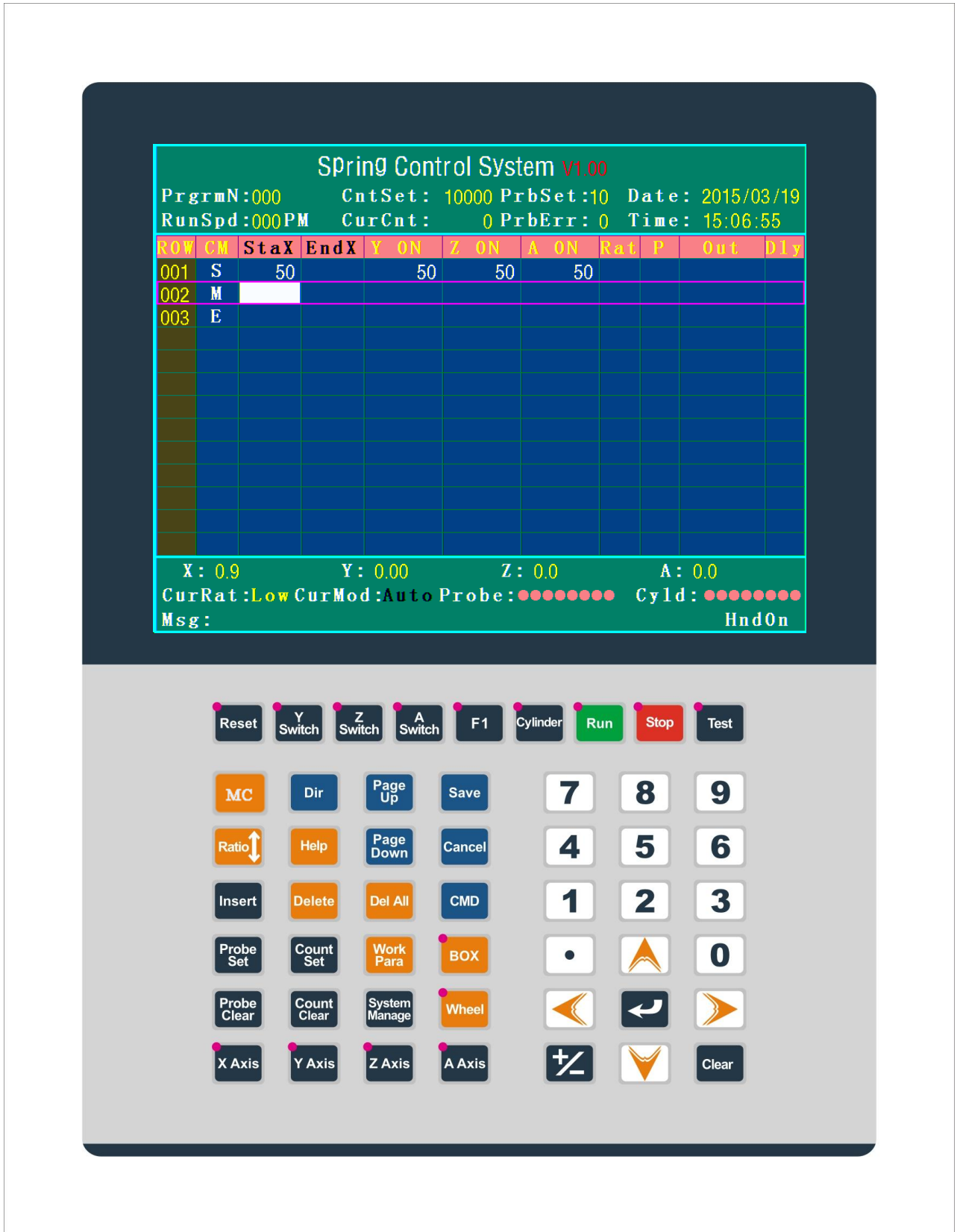


Fig.2-1

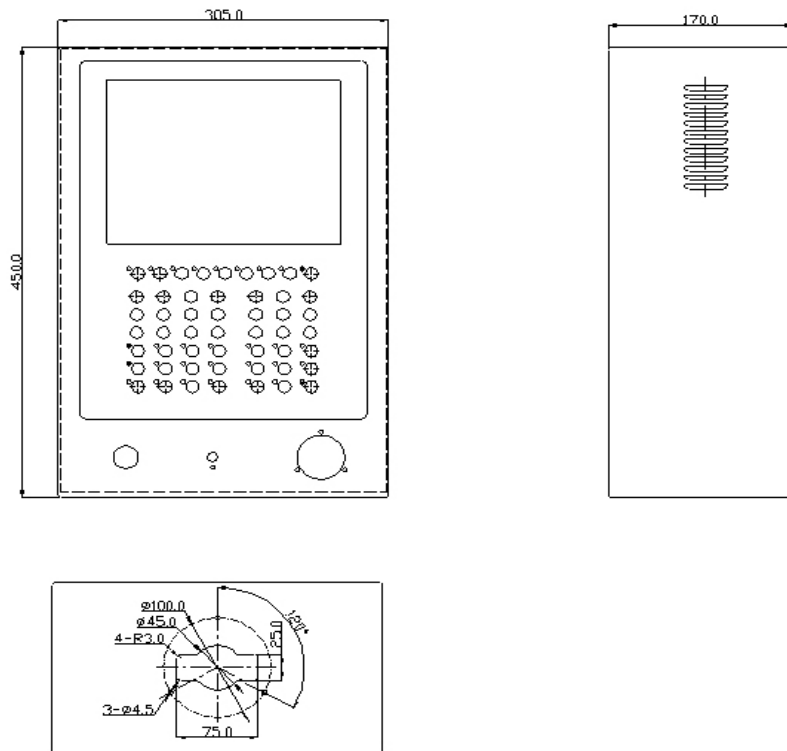


Fig. 2-2

## 2.2 Interface definition

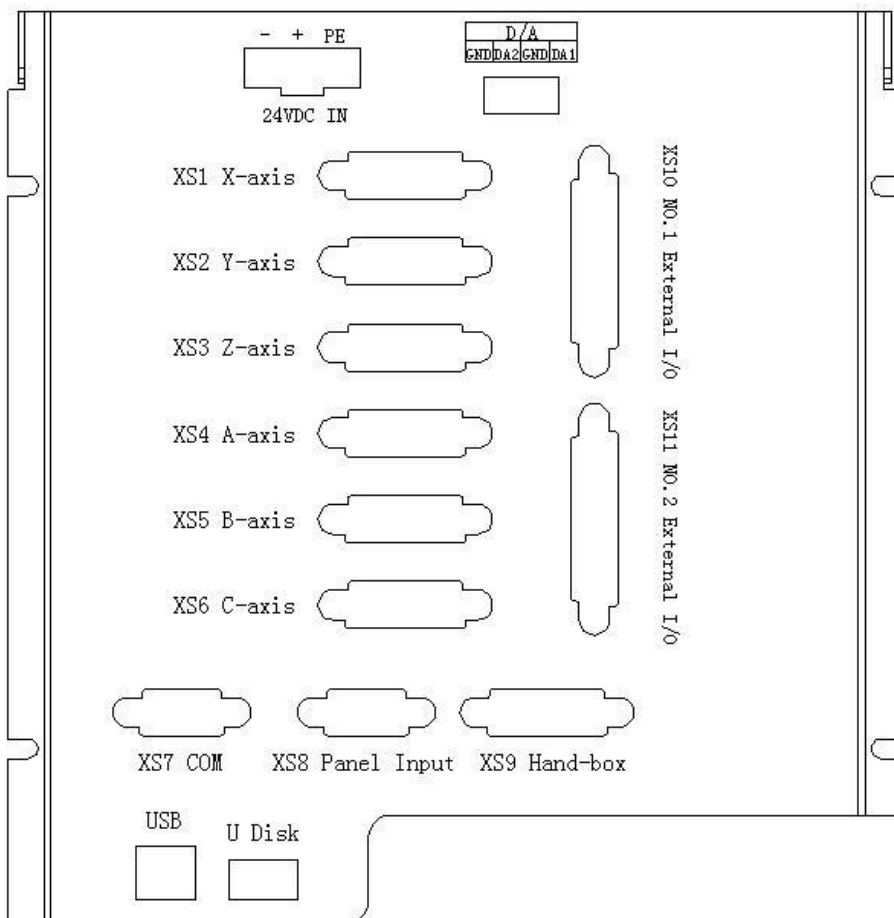


Fig. 2-3

2.3 Electrical connection diagram

2.3.1 Terminal diagram

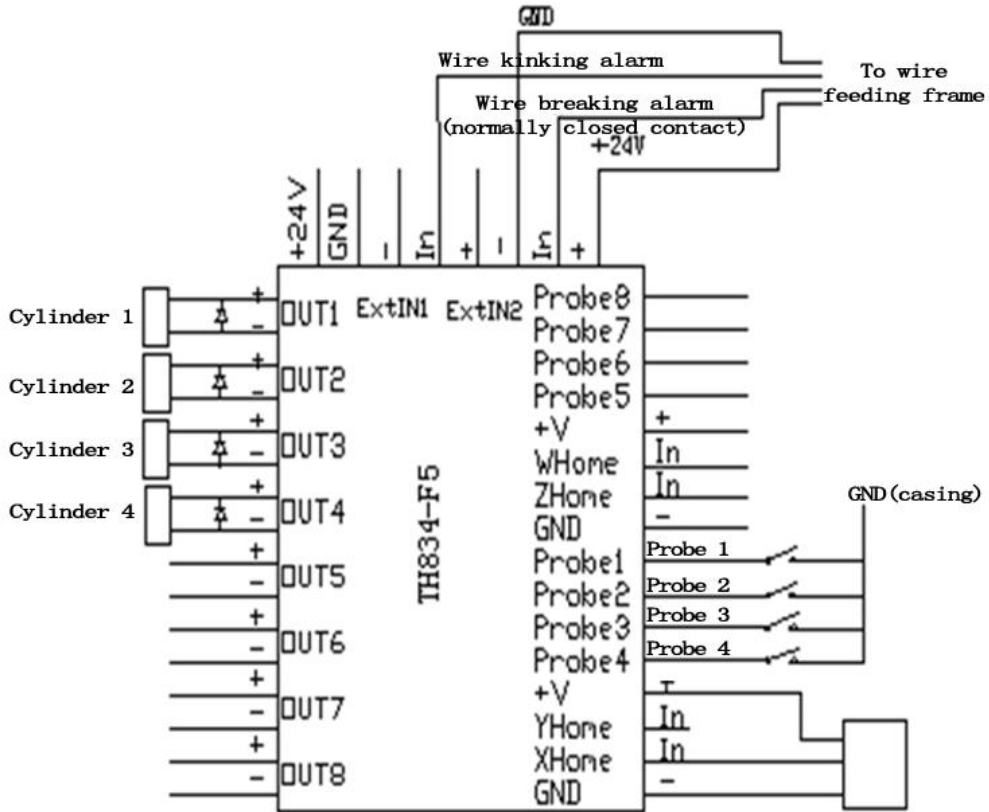


Fig. 2-4

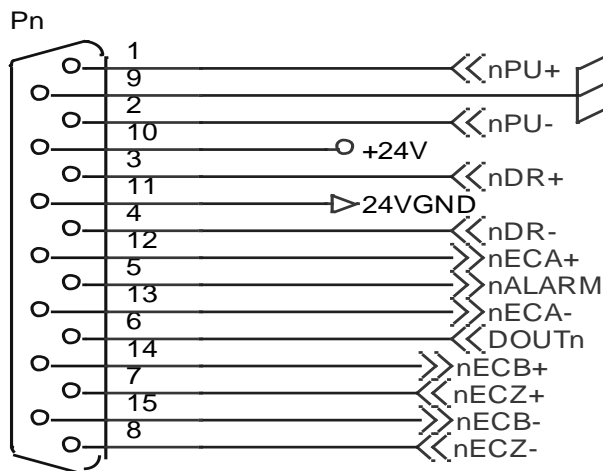
Note: All the positive poles on the board have been shorted to +24V, and all negative poles have been short to GND. The leads are for convenient wiring only.

2.3.2 Terminal description

The wiring board has totally four origin input signal interfaces, 8 probe input interfaces, 8 cylinder output interfaces, one wire feeding frame kinking input interface, one wire breaking alarm input interface, and a set of +24V and GND interfaces for external DC24V power.

2.3.3 Wiring definition

(1) 15-pin signal socket (XS1/ XS2/ XS3/ XS4/ XS5/ XS6)



CONNECTOR DB15

DB15SF2

Fig. 2-5

Wire No.	Definition	Function
1	nPU+	Pulse signal +
2	nPU-	Pulse signal -
3	nDR+	Direction signal +
4	nDR-	Direction signal -
5	nALARM	Universal input point, used as alarm input (X-34 Y-35 Z-36 A-37 B-38 C-39)
6	OUTn	Universal output point (X-18 Y-19 Z-20 A-21 B-22 C-23)
7	nECZ+	Encoder Z-phase input + (X-42 Y-45 Z-48 A-51 B-54 C-57)
8	nECZ-	Encoder Z-phase input -
9	GND	5V power grounding, for internal use
10	+24V	Provide DC24V power externally for drive signal use, can't be used for large load power supply
11	24VGND	
12	nECA+	Encoder A-phase input + (X-40 Y-43 Z-46 A-49 B-52 C-55)
13	nECA-	Encoder A-phase input -
14	nECB+	Encoder B-phase input + (X-41 Y-44 Z-47 A-50 B-53 C-56)
15	nECB-	Encoder B-phase input -

(2) 9-pin signal socket (XS8)

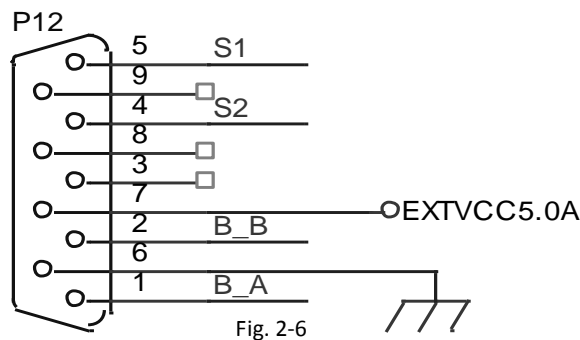


Fig. 2-6

Wire No.	Definition	Function
1	ECB	B-phase handwheel input
2	ECA	A-phase handwheel input
3	NC	Null
4	STOP	Stop button input
5	START	Start button input
6	GND	Negative pole of internally provided 5V power supply for handwheel
7	+5V	Positive pole of internally provided 5V power supply for handwheel
8	NC	Null
9	NC	Null

(3) 15-pin signal socket (XS9)

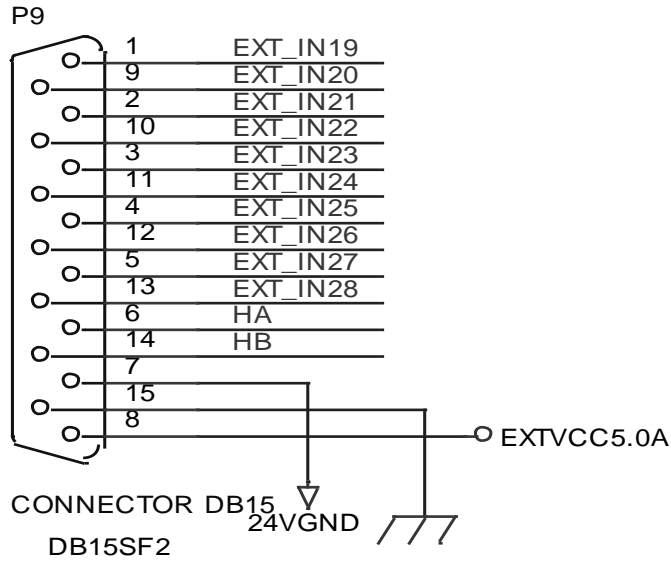


Fig. 2-7

Wire No.	Definition	Function
1-5, 9-13	External input	Can be used as universal input
6	Handheld box input	Handheld box phase A
14	Handheld box input	Handheld box phase B
7	24V	Common end of universal input
8	EXTVCC5.0A	Handheld box 5V power
15	GND	Handheld box 5V power ground

(4) 25-pin signal socket (XS11)

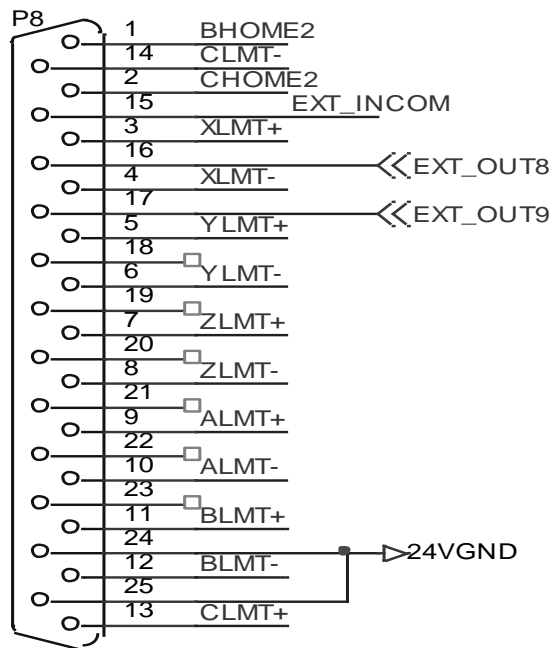


Fig. 2-8

Wire No.	Definition	Function
1	BHOME2	B-axis home 2
2	CHOME2	C-axis home 2
3	XLMT+	X-axis limit +
4	XLMT-	X-axis limit -
5	YLMT+	Y-axis limit +
6	YLMT-	Y-axis limit -
7	ZLMT+	Z-axis limit +
8	ZLMT-	Z-axis limit -
9	ALMT+	A-axis limit +
10	ALMT-	A-axis limit -
11	BLMT+	B-axis limit +
12	BLMT-	B-axis limit -
13	CLMT+	C-axis limit +
14	CLMT-	C-axis limit -
15	EXT_INCOM	Common end of external input (+24V)
16	EXT_OUT8	Universal output
17	EXT_OUT9	Universal output
18--23	NC	Null
24	24VGND	24V power ground
25	24VGND	24V power ground

(5) 25-pin signal socket (XS10)

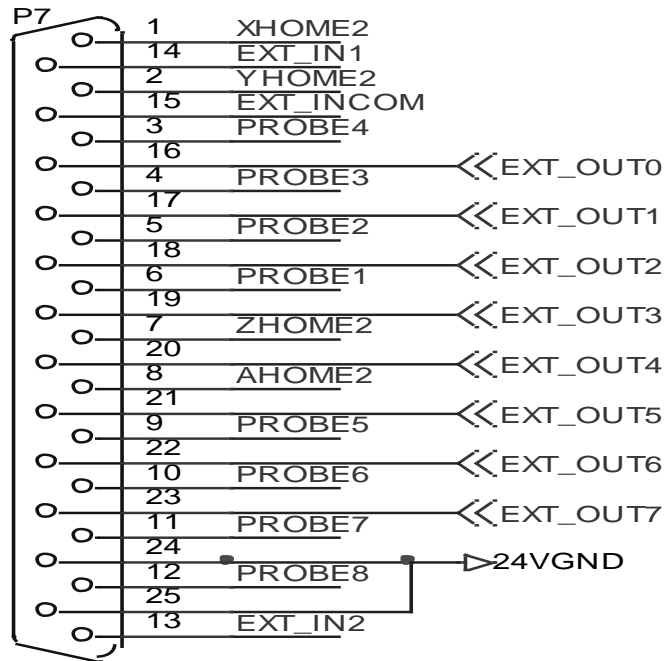


Fig. 2-9

Wire No.	Definition	Function
1	XHOME2/IN2	X external home signal (input)
2	YHOME2/IN7	Y external home signal (input)
3	PROBE4/IN8	Probe input signal
4	PROBE3/IN9	Probe input signal
5	PROBE2/IN3	Probe input signal
6	PROBE1/IN4	Probe input signal
7	ZHOME2/IN12	Z external home signal (input)
8	AHOME2/IN17	A external home signal (input)
9	PROBE5/IN14	Probe input signal
10	PROBE6/IN13	Probe input signal
11	PROBE7/IN19	Probe input signal
12	PROBE8/IN18	Probe input signal
13	IN21	Common input signal
14	IN20	Common input signal
15	INCOM1	Common end of output, connected to positive terminal of external power supply
16	OUT0	Cylinder output 0
17	OUT1	Cylinder output 1
18	OUT2	Cylinder output 2
19	OUT3	Cylinder output 3
20	OUT4	Cylinder output 4
21	OUT5	Cylinder output 5
22	OUT6	Cylinder output 6
23	OUT7	Cylinder output 7
24	OUTCOM1	Common end OUTCOM1 of output, connected to negative terminal of external power supply
25	OUTCOM1	

(6) D/A output

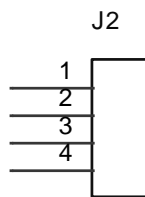


Fig. 2-10

Wire No.	Definition	Function
1	DAOUT0	Analog voltage channel 0
2	DAGND	Analog voltage reference ground
3	DAOUT1	Analog voltage channel 1
4	DAGND	Analog voltage reference ground

## Chapter 3 Operating Instructions

### 3.1 Operation Panel

#### 3.1.1 Keyboard and Keys



Fig. 3-1

**Reset:** Press this key to reset the system, with resetting sequence as follows: X axis, Y axis, Z axis, and A axis. After resetting, the indicator of the key will be extinguished.

**Y switch:** Use this switch to control the Y axis. When the Y axis is turned off, the corresponding red indicator will be illuminated and the words “Y axis (off)” appear on the screen. Otherwise, the red indicator will be extinguished and the words “Y axis (on)” appear on the screen.

**Z switch:** Use this switch to control the Z axis. When the Z axis is turned off, the corresponding red indicator will be illuminated and the words “Z axis (off)” appear on the screen. Otherwise, the red indicator will be extinguished and the words “Z axis (on)” appear on the screen.

**A switch:** Use this switch to control the A axis. When the A axis is turned off, the corresponding red indicator will be illuminated and the words “A axis (off)” appear on the screen. Otherwise, the red indicator will be extinguished and the words “A axis (on)” appear on the screen.

**F 1:** Reserved function.

**Cylinder:** Use this key to control the cylinder test state. Only when the system is in the stop mode, can it enter the cylinder test state. Once in the cylinder test state, the corresponding red indicator will be illuminated. At the time, if you press the numeric keys “1-8”, the cylinder corresponding to the number will act. Press it to protrude the cylinder, and press it again to retreat it. After you press the key Cylinder to exit the cylinder test state, the 1-8 cylinders will be automatically turned off.

**Start:** Start the machine and begin normal processing operations.


**Stop:** In normal stop state, press this key to machine one spring. In auto machining state or test machining state, press this key, and the machine will stop after the current operation is completed. In any other single-axis drive state or resetting state, press this key to stop the drive immediately.

**Test:** In the main interface, use this key to switch over between auto mode and test mode. In auto mode, you can conduct the normal machining operation. At the time, the quantity of machining will be added by 1 each time after the machining is completed. In auto mode, if you press the test key, the system will enter the test mode to start the test machining. In test machining state, you can use the hand wheel or test knob to perform the machining.

**MC (material code):** Select the file number (0-99) for machining.

**Dir:** Reserved function

**Help:** Pop up system information, including item number, software version, hardware version, program release time, and library version number.

**Rate**  : Use it to set the high-low speed rate in inching or manually moving the shafts.

**Page Up/Page Down:** Press this button to turn pages.

**Save:** Use it to save the edited programs. Remember if you change the programs a lot you'd better press this key to avoid data loss at the time of power failure. Press this key to save the data change and exit. In editing the material code, you can also press this key to save the data to the corresponding material code.

**Cancel:** In selecting the program, press this key to give up the selection. In the interface for changing the parameters, press this key to give up and exit.

**Interpolate:** Use it to insert a line of instruction program before the white cursor.

**Delete:** Use it to delete the program where the cursor is.

**Delete all:** Use it to delete all programs except the speed setting line. Before that, the system will ask whether all data need to be deleted.

**Instruction:** Press the button to show the related instructions in corresponding column, press the button every time, and the instruction will switch among "S, M, L, N, G, J, E"; the final stop command is the one used by the line. Below are the meanings of the instructions:

Instruction	Definition
S	Set the speed of the action axis
L	First symbol of loop body
N	Last symbol of loop body
M	Feed, spin, rotate, feed trace, speed ratio and probe cylinder
J	Jump instruction with condition
G	Jump instruction without condition
E	Program end

**Probe Setting:** To set the failure times for the probe. In operation with probe, the system will add up the failure times for the probe at each time. When the failure times reach the set number, the system will stop automatically and the warning dialogue box will be popped up.

**Probe Zero:** To clear the failure times for the probe. Once the failure times reach the set value, the system will pop up a dialogue that prompts you the failure times have reached a certain value. At the time, press "Enter" to clear the failure times.

**Production Setting:** To set the quantity of the springs to be machined. Once the quantity of the machined springs reaches the set value, the system will automatically stop and pop up the dialogue box to remind the user.

**Production Zero:** To clear the quantity of machined pieces. Press this key, and the system will pop up the dialogue box shown below to ask you to confirm whether you need to clear the quantity of machined pieces. If you select “Yes”, you clear the quantity. If “No”, not clear.

In the mode of continuous machining, once the quantity of machined pieces reaches the set value, the system will pop up the dialogue box shown below. At the time, you can press “Enter” to clear the quantity.

**Working parameters:** Pop up the window of working parameter setting interface, which will be described in details below.

**System management:** Press this key to set up the auxiliary functions. For details, please refer to the related description.

**Pendant:** It is a switch to control the pendant. Once it is pressed, the ON/OFF state of the pendant will appear on the screen. At the same time, if the red indicator on the key is illuminated, it means the pendant can be operated. When the pendant is turned on, the system will automatically shut off the hand wheel function. This key is effective only when the system is configured with the pendant.

**Hand wheel:** It is a switch to select the hand wheel. Press this key, and the ON/OFF state of the hand wheel will appear on the screen. At the same time, if the red indicator on the key is illuminated, it means the hand wheel can be operated. When the hand wheel is turned on, the system will automatically shut off the pendant function.

X-axis, Y-axis, Z-axis, A-axis: selection buttons of axis X, Y, Z and A respectively; select the appropriate axis, and rotate the handwheel to move corresponding axis.

**Clear:** Use it to clear the contents within the current edit box.

+/-: Switch between positive and negative of the data in current editing position.

← → ↑ ↓ : Use these navigation keys to move the edit box leftward, rightward, upward and downward.

↵ : Use this key to confirm the entered data. Press it after editing. At the time, the edit box moves down for one grid.

The system uses real-time storage capabilities, namely in the programming process, the processing file will be saved in real-time every time you press “Insert”, “Delete” and “OK”.

**3.1.2 Buttons on the Panel**

The controller has one test knob and one mushroom-shaped button switch, and the latter is the emergency stop button. In any emergency, press this E-stop button to immediately stop the current drive. Once it is pressed, all other buttons and keys will become ineffective. In the interface where the parameters are set, the system will not save the data but exit if this button is pressed. The test knob is used for test machining. In test machining, turn this knob rightward, and the test machining will be accelerated till it reaches the maximum value that is set; turn it leftward, decelerated till the minimum set value, and the machining stops. Some controllers might be configured with handwheel. If so, you must set the handwheel installation as 1 during parameters configuration. Otherwise, the handwheel will become ineffective. After the handwheel is installed, you can select the ON/OFF state for the system through the item “Handwheel”. Only when the handwheel is at ON state, can the parts be moved by the handwheel.



- 7) Display the current date and time for the user's reference
- 8) Message: Display and maintain the last message.
- 9) Display the current operating mode of the system (test mode and automatic mode)
- 10) Display the hand speed (high, medium & low)
- 11) Remaining time: The time needed to finish the target quantity. (In automatic processing mode, if "display the remaining parameters" is set to 1 in working parameters, the remaining time display function will be enabled)
- 12) Input: Display the current status of 1#-8# probe.
- 13) Output: Display the current status of 1#-8# cylinder.
- 14) Location: Display the coordinates of X, Y, Z, A-axis.

## 2. Program editing:

- 1) Line No.: Indicate the line number of the program.
- 2) Command: Indicate the command code of the program; the range is the data in (M, S, L, N, J, G, and E).
- 3) Start X: Indicate the location of the camshaft (-360 to 360)
- 4) End X: Indicate the location of the camshaft (-360 to 360)
- 5) Wire feeding: Indicate the wire feeding length (-999.99 ~ 9999.99, unit: mm). Multiple modes are also available for Y axis: single turn, multi-turn, screw, wire feeding.
- 6) Z-axis: When three-axis or four-axis is selected, Z-axis has three operating modes: Single turn, multi-turn, screw.
- 7) A-axis: When four-axis is selected, A-axis has three operating modes: Single turn, multi-turn, screw.
- 8) Ratio: Indicate the ratio of processing speed to achieve the corresponding speed change (0.01~5.0)
- 9) Probe: Indicate the input of probe number (1~8)
- 10) Cylinder: Two modes are available: 01 sequence or combination sequence of +/- and digits
- 11) Delay: Unit: second. Run to the start angle, open the cylinder, and implement the delay action.

3.2.2 Accessibility interface

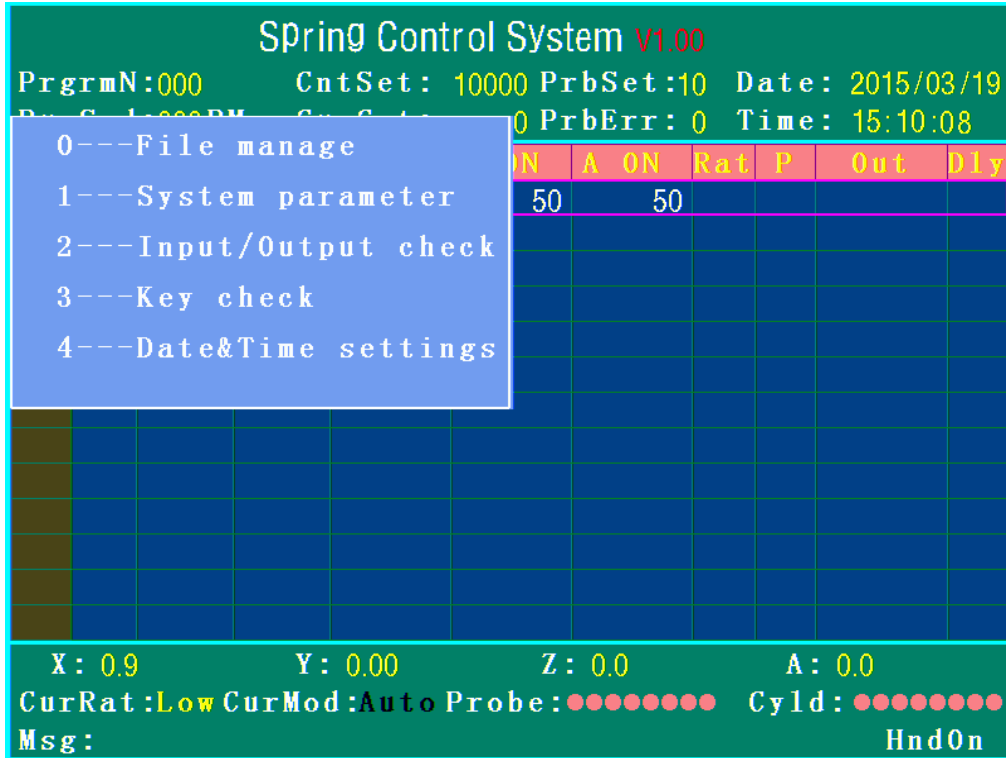


Fig. 3-3

Then, press the corresponding number keys to enter the interface.

3.2.3 Processing file management interface

Press “0” to enter the processing file management interface as below:

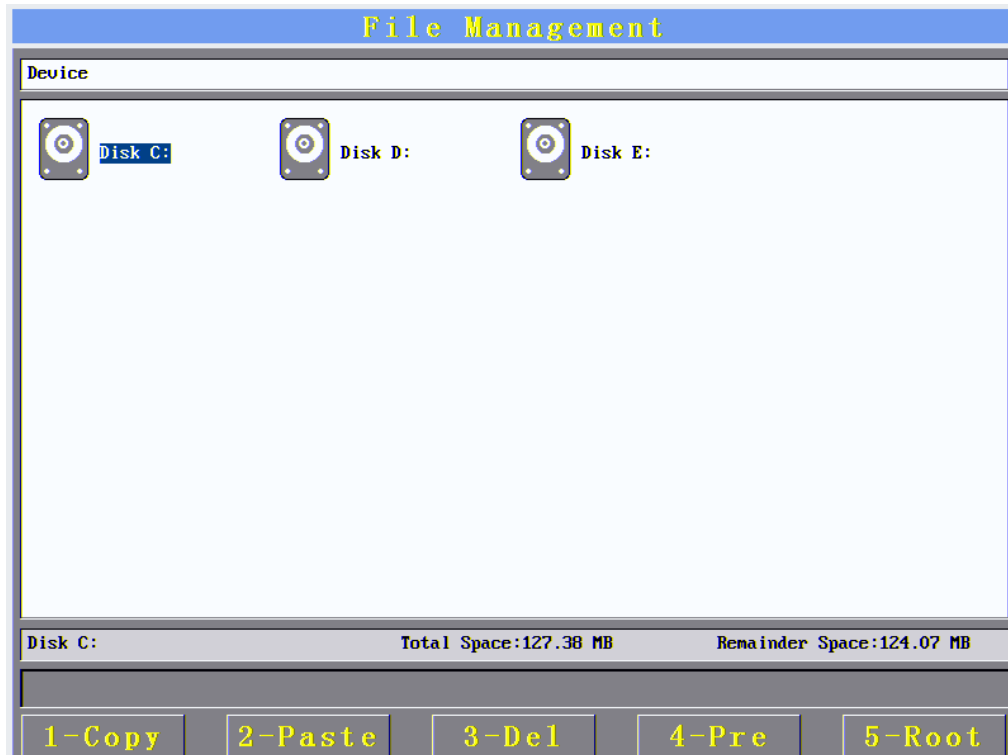


Fig. 3-4

Then, you can press the arrow keys to select the disk. C is yaffs disk, D is FAT disk, and E is external USB disk.

Press “Enter” to enter the appropriate disk as shown below:

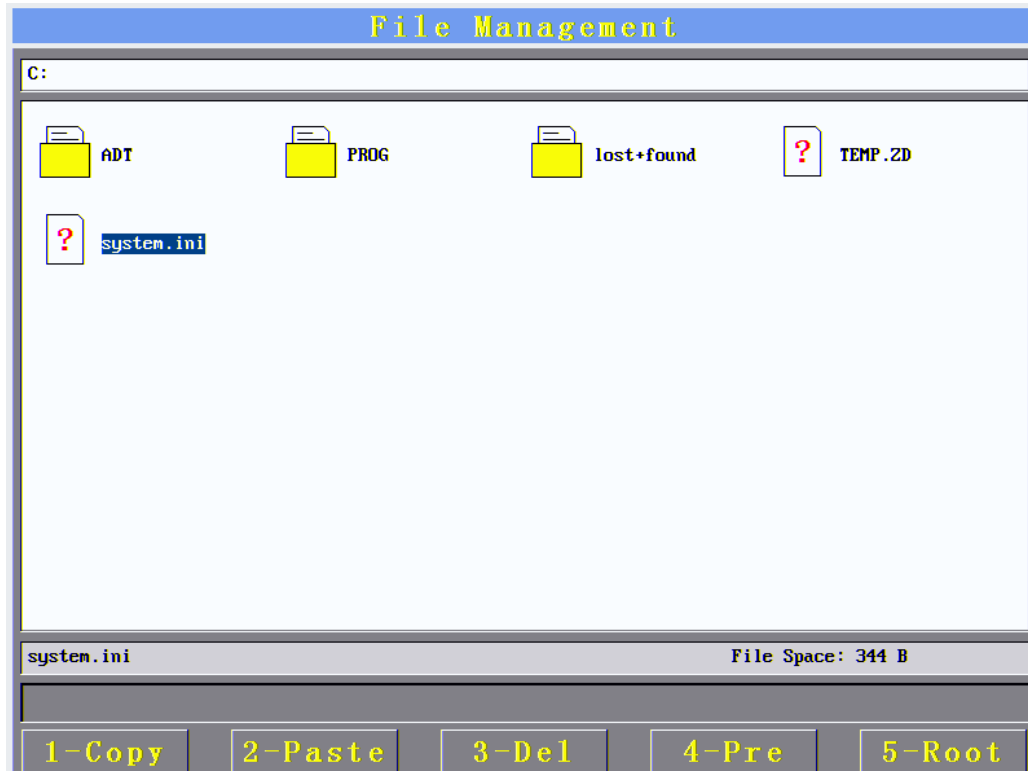


Fig. 3-5

Press “1” to copy files; press “2” to paste the copied file to current directory; press “3” to delete the file or folder where the cursor locates, press “Enter” to confirm the operation or press “Cancel” to cancel the operation when the system prompts “Y/N”; press “4” to return to the previous directory; press “5” to return to the root directory; press “Cancel” to exit the file management system and return to the main processing interface.

When using removable USB disk, the USB disk must be formatted in FAT, or else the file reading may be improper.

### 3.2.4 System parameter setting interface

Press “1” to perform password verification (default initialization password of the system is 123) and enter the system parameter setting interface as below:

System parameter			
001, X Pulse	16384	016, A Back Dir	0
002, Y Pulse	16384	017, X Ratio	1.0
003, Z Pulse	16384	018, Y Ratio	1.0
004, A Pulse	16384	019, Z Ratio	1.0
005, X Angle	360.0	020, A Ratio	1.0
006, Y Angle	360.0	021, X Speed	2000
007, Z Angle	360.0	022, Y Speed	2000
008, A Angle	360.0	023, Z Speed	2000
009, X Dir	0	024, A Speed	2000
010, Y Dir	0	025, X Handspeed	60.0
011, Z Dir	0	026, Y Handspeed	60.0
012, A Dir	0	027, Z Handspeed	60.0
013, X Back Dir	0	028, A Handspeed	60.0
014, Y Back Dir	0	029, X Backspeed	90.0
015, Z Back Dir	0	030, Y Backspeed	90.0
001, X Axis:Pulse of a Circle. Range 200~40000			
<sup>Clu</sup> BackUp <sup>1</sup>	ReBack <sup>2</sup>	<sup>3</sup>	PrePg NextPg Save Cancel

Fig. 3-6

System parameter			
031, Z Backspeed	90.0	046, Z RunMode	0
032, A Backspeed	90.0	047, A RunMode	0
033, X WarnLog	0	048, X BackMode	1
034, Y WarnLog	0	049, Y BackMode	1
035, Z WarnLog	0	050, Z BackMode	1
036, A WarnLog	0	051, A BackMode	1
037, X SevZero	0	052, Y LimitPlus	0.0
038, Y SevZero	0	053, Y LimitDec	0.0
039, Z SevZero	0	054, Z LimitPlus	20.0
040, A SevZero	0	055, Z LimitDec	30.0
041, XName	0	056, A LimitPlus	30.0
042, YName	1	057, A LimitDec	30.0
043, ZName	0	058, XHard Switch	0
044, AName	0	059, YHard Switch	0
045, Y RunMode	3	060, ZHard Switch	0
031, BackSpd. Deg/sec. Range 0.1~1000.0, default90.0			
<sup>Clu</sup> BackUp <sup>1</sup>	ReBack <sup>2</sup>	<sup>3</sup>	PrePg NextPg Save Cancel

Fig. 3-7

System parameter			
061, AHard Switch	0	076, Hand Ratio	70.0
062, YZeroForLimt	0	077, ParaSet Psw	***
063, ZZeroForLimt	0	078, Machine Name	0
064, AZeroForLimt	0	079, Language	0
065, BackzeroOrd	3412		
066, Probe Ahead	0		
067, Probe Behind	0		
068, Axis Count	4		
069, CylinderMode	0		
070, Start Speed	2.0		
071, Add Speed	2000		
072, X Max Speed	500.0		
073, ReverseDly	20		
074, LineBrk Log	1		
075, HandTest Spd	2		
061, A HardLimit Check Switch. 0:No, 1:Yes, default 0			
Clu BackUp <sup>1</sup>	ReBack <sup>2</sup>	<sup>3</sup>	PrePg NextPg Save Cancel

Fig. 3-8

- 1) X, Y, Z, A-axis pulse: the number of pulses corresponding to each revolution of X, Y, Z, A-axis, which must match the setting of the drive.
- 2) X, Z, A rotation angle: the rotation angle of X-axis when sending the number of pulses set by the first option, which is set to 360. (In single turn or multi-turn mode, it indicates the rotation angle corresponding to the number of pulses; in screw mode, it indicates the screw pitch corresponding to the number of pulses)
- 3) Y feeding length: the feeding length of the axis when sending the number of pulses set by the first option, which is usually the circumference of wire feeding wheel. (In single turn or multi-turn mode, it indicates the rotation angle corresponding to the number of pulses; in screw mode, it indicates the screw pitch corresponding to the number of pulses)
- 4) X, Y, Z, A running direction: running direction corresponding to X, Y, Z and A.
- 5) X, Y, Z, A home direction: home direction corresponding to zero X, Y, Z, and A.
- 6) X, Y, Z, A reduction ratio: the mechanical reduction ratio of each axis.
- 7) X, Y, Z, A motor speed: Set the rated motor speed of each axis.
- 8) X, Y, Z, A manual speed: manual speed of each axis (the speed when each axis is manually moved separately).
- 9) X, Y, Z, A home speed: the home speed of each axis.
- 10) X, Y, Z, A alarm logic: servo alarm logic level of each axis.
- 11) X, Y, Z, A servo home: whether each axis returns to servo home.
- 12) X, Y, Z, A axis name: 0: default, 1: feed, 2: reel, 3: turn, 4: pitch, 5: wind, 6: clip, 7: cutter, 8: cam, 9: screw.
- 13) Y, Z, A running mode: Z-axis and A-axis have three running modes: single turn, multi-turn, and screw. Y-axis has four modes: Single turn, multi-turn, screw, and wire feeding
- 14) X, Y, Z, A home mode: home mode after three-axis processing: nearest, forward, and reverse. (In feeding mode and screw mode, home mode parameter setting is invalid)
- 15) Y, Z, A-axis positive/negative soft limit: positive/negative soft limit of Y, Z, A-axis. (Valid for single turn and screw mode)

- 16) X, Y, Z, A-axis hardware limit detection: 0: No; 1: Yes.
- 17) Whether use home as negative limit for Y, Z, A: for screw mode, whether use the home signal as the negative limit signal.
- 18) Axis home sequence. Four-axis mode is expressed in four digits, e.g. 3412 indicate that the home sequence is 3, 4, 1, 2. Three-axis mode is expressed in three digits, e.g. 312 indicate that the home sequence is 3, 1, 2. Two-axis mode is expressed in two digits, e.g. 21 indicate that the home sequence is 2, 1.
- 19) Advance/lag probe delay: Set the advance and lag time of probe line.
- 20) System axes: Select the axes of the spring control system; supports 2-4 axis mode.
- 21) Cylinder mode: Support 01 sequence and combination of +/- and digits. Cylinder mode 0 corresponds to sequence 01: 1111 indicates opening cylinder 1~4, 101 indicates opening cylinder 1, 3 and closing cylinder 2. Cylinder mode 1 corresponds to the combination of +/- and digits: 1234 indicates opening cylinder 1~4, and -1-2-3 indicates closing cylinder 1, 2, 3.
- 22) Start speed: The initial speed when the motor starts.
- 23) Acceleration: Acceleration after the motor starts.
- 24) X-axis maximum speed: Maximum rotation speed of X-axis
- 25) Positive and negative delay ratio: the delay ratio when the direction changes.
- 26) Breaking alarm logic: logic level of breaking alarm.
- 27) Hand speed: Set the counting parameters of hand processing; if this value is too big, it will produce hysteresis between hand processing and hand operation stop; if the value is too small, the processing may jitter when the hand wheel is rotated slow; it is usually set to 2.
- 28) Hand ratio: set the speed change ratio of hand processing; the change doesn't change significantly if the value is too big, and will change significantly if the value is small; it is usually set to 70.
- 29) System password: Set the password to enter system parameter setting interface.
- 30) Machine name: Set the title name of controller system according to the specific parameters. 0: spring machine, 1: spring compression machine; 2: spring torsion machine.
- 31) Language: Select system language (0: Chinese, 1: English)

Press the "Cylinder" key to activate the numeric function keys, and press it again to deactivate the numeric function keys. When activated, press "1" to backup system parameters to FAT disk; press "2" to restore the system parameters to the current parameter settings.

Press the Up, Down, Left, Right, Page Up and Page Down button to move the cursor and turn pages, which will facilitate parameter setting.

Press the [Save] key to save the current data and exit the interface, or press the [Cancel] key to cancel the data and exit the interface.



**Note:**

System parameters are necessary conditions to ensure system running; do not change under normal circumstances.

### 3.2.5 Working parameter setting interface

Press the “Working parameters” button to enter the working parameter setting interface as below:

System parameter	
001, Screen Pro	1
002, ScnPro Time	10
003, Pic Protect	1
004, DispRunTime	1
005, LineRacks	1
006, Warning Out	0
007, PaoXianCheck	0
008, AxisY Rev	1
009, XStartOffset	0.0
010, YStartOffset	0.0
011, ZStartOffset	0.0
012, AStartOffset	0.0

001, Screen Protect. 1:Yes, 0:No

Save Cancel

Fig. 3-9

- 1) Screen protection: Set whether to turn off the screen display after the time set in automatic processing
- 2) Screen protection time: Set the time to turn off the screen after automatic processing begins (unit: minute).
- 3) Picture protection: Whether use picture for screen protection; when screen protection is enabled and picture protection is selected, the system will call the start screen automatically after the time set in automatic processing state, or else the backlight turns off.
- 4) Display running time: whether pop up the remaining time during automatic processing.
- 5) Wire rack drive: Specify whether the last cylinder output point drives the wire rack, 1: Yes, 0: No. Note: When this parameter is set to 1, do not use the 8<sup>th</sup> output point for cylinder programming.
- 6) Alarm output: 1: Yes, 0: No. Signal output point is the 10<sup>th</sup> output point.
- 7) Line offset check: Indicate whether to check line offset, select 1 to enable the check, and the last probe (8#) will be used as line offset check input signal.
- 8) Y hand wheel reverse line: whether reverse the line when the hand wheel is rotated in opposite direction to move Y-axis separately when Y-axis is in feeding mode, 1: Yes, 0: No.
- 9) X-axis home offset: set the offset location of X-axis, i.e. the rotation angle of X-axis after finding the home position switch, which is intended to facilitate the setting of X-axis home position (unit: degree).
- 10) Y-axis home offset: set the offset location of Y-axis, i.e. the rotation angle of Y-axis after finding the home position switch, which is intended to facilitate the setting of Y-axis home position. In single turn and multi-turn mode, the unit is °; in screw mode, the unit is mm.
- 11) Z-axis home offset: set the offset location of Z-axis, i.e. the rotation angle of Z-axis after finding the home position switch, which is intended to facilitate the setting of Z-axis home position (only valid for the system with at least three axes). In single turn and

multi-turn mode, the unit is °; in screw mode, the unit is mm.

- 12) A-axis home offset: set the offset location of A-axis, i.e. the rotation angle of A-axis after finding the home position switch, which is intended to facilitate the setting of A-axis home position (only valid for the system with at least three axes). In single turn and multi-turn mode, the unit is °; in screw mode, the unit is mm.

Press the [Save] key to save the current data and exit the interface, or press the [Cancel] key to cancel the data and exit the interface.

### 3.2.6 Input/output check interface

Press “2” to enter the input/output check interface as below:

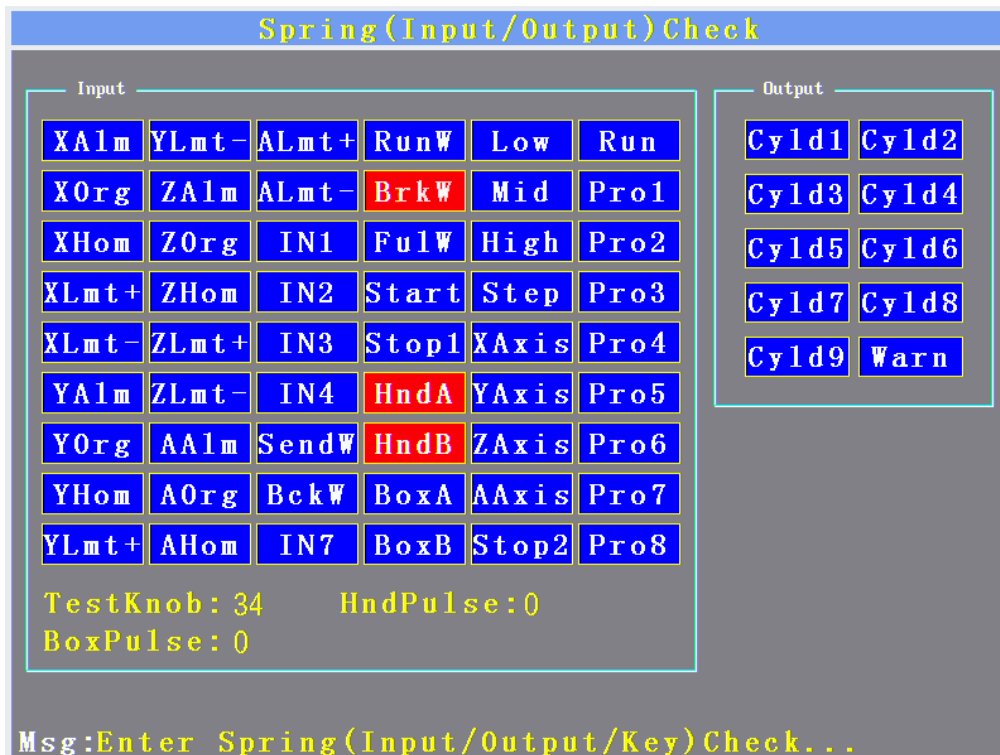


Fig. 3-10

- 1) The blue rectangle in the left is the input port and it turns red when the corresponding input port has input signal; for signal check of probe 1~8, these signals and the previous signals expressed in digits will be displayed in different colors at the same time; if only the digital signals change, the control card has problem and should be replaced.
- 2) The ten in the center are output ports 0-9, and you can press number 0-9 to output digital signals of channel 0-9; when output occurs, the system is displayed in red and has corresponding font, or else the system is displayed as shown in the figure.
- 3) Select an axis and then press the Home key; after homing, press the Home key again to calculate the number of pulses corresponding to single turn of the axis. The message bar in the bottom of the screen has corresponding display.

Press the “Cancel” key to exit the interface.

3.2.7 Key check interface

Press "3" to enter key check interface as shown below:

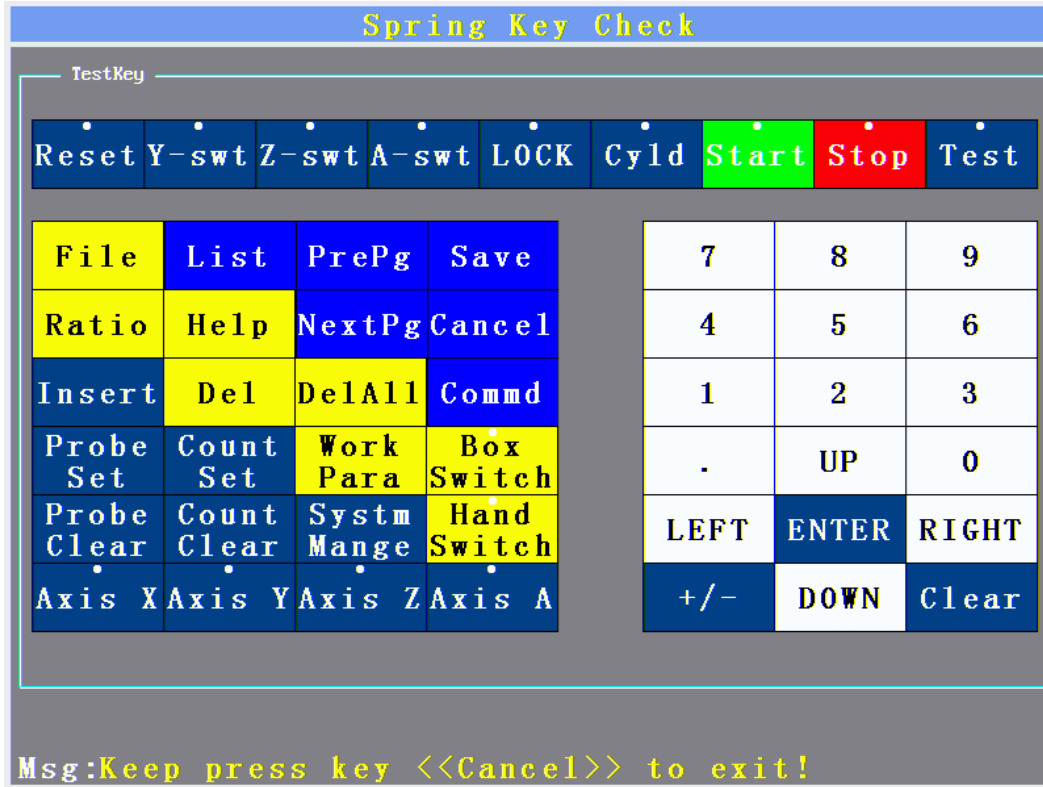


Fig. 3-11

The function of each key is tested in this interface; press and hold the [Cancel] key to exit this interface.

3.2.8 Time setting interface

Press "4" to enter key check interface as shown below:

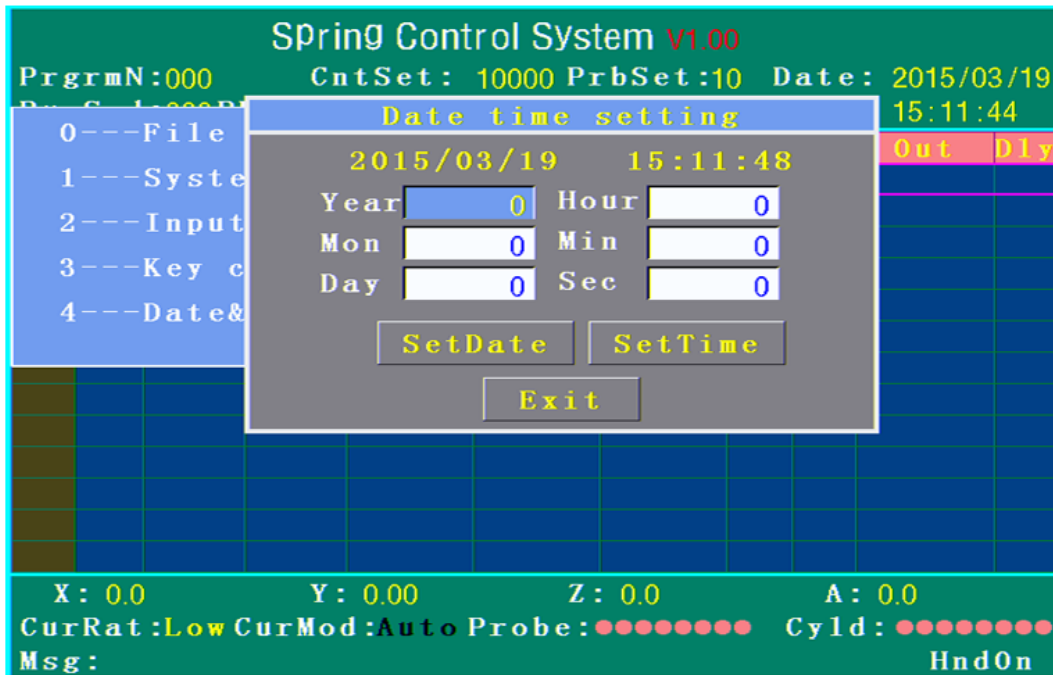


Fig. 3-12

Encryption process and decryption process require that the controller and PC should have consistent date and basically the same time, or else it may cause problems for encryption and decryption.

### 3.3 Program instructions and examples

#### 3.3.1 Instruction definition and description

1) S instruction: speed instruction.

Instruction format:

Line No.	Instruction	Start X	End X	Y axis	Speed ratio	Probe	Cylinder
Line No.	S	X speed		Y speed			

Description: used to set the base speed of motion axis; it must be set before the motion of a segment of instructions; multiply its speed ratio and the speed ratio of following M instruction to obtain the interpolation speed of M instruction motion.

X speed: the motion speed of X-axis when X-axis moves, and Y-axis motion follows. Unit: r/min.

Y speed: the motion speed of Y-axis when X-axis doesn't move. Unit: m/min.

Other items are invalid for S instruction.

2) M instruction: motion instruction

Instruction format:

Line No.	Instruction	Start X	End X	Y axis	Speed ratio	Probe	Cylinder
Line No.	S	X speed		Y speed			
Line No.	M	X start angle	X end angle	Y length/angle	Speed ratio	Probe No.	Cylinder state

Description: motion instruction; X-axis first moves to X start angle and then executes cylinder action, and checks the set probe signal when X-axis and Y-axis move to X end angle and Y-axis feeding length at the same time.

If an option in M instruction is null, skip this action.

X start angle: uniaxial angle of X-axis.

X end angle: X-axis end angle.

Y length: the feeding length of Y-axis when X moves to the angle.

Z-axis: display Z axis in three-axis mode; three modes are available: single turn, multi-turn, screw

Speed ratio: the speed of M instruction is the speed set by the nearest S instruction multiplying the speed ratio. The default ratio is 1.

Probe No.: Set the probe number checked when X-axis and Y-axis move to end angle and feeding length at the same time.

Cylinder: Set the cylinder number when the X-axis moves to the start angle.

3) E instruction: End instruction

Instruction format:

Line No.	Instruction	Start X	End X	Wire feeding	Speed ratio	Probe	Cylinder
Line No.	S	X speed		Y speed			
Line No.	M	X start angle	X end angle	Y length/angle	Speed ratio	Probe No.	Cylinder state
Line No.	E						

Description: End instruction; each processing program must have the end instruction, or else the format will have error; and the process must run to the E instruction eventually, or else the processing will enter infinite loop.

The instruction does not require settings of other items.

4) L, N instruction: cycle instructions

Instruction format:

Line No.	Instruction	Start X	End X	Wire feeding	Speed ratio	Probe	Cylinder
Line No.	S	X speed		Y speed			
Line No.	L	Number of cycles					
Line No.	M	X start angle	X end angle	Y length/angle	Speed ratio	Probe No.	Cylinder state
Line No.	N						
Line No.	E						

Description: L instruction and N instruction constitute cycle instruction, which is used for loop processing of the block between L instruction and N instruction

At the beginning of L instruction, the X line is the number of cycles of the program. L instruction and N instruction must appear in pair, and can be nested up to three levels.

Number of cycles: the number of cycles of the block between L instruction and N instruction.

Other items of this instruction do not need setting.

5) J instruction: Conditional jump instruction

Instruction format:

Line No.	Instruction	Start X	End X	Wire feeding	Speed ratio	Probe	Cylinder
Line No.	S	X speed		Y speed			
Line No.	L	Number of cycles					
Line No.	M	X start angle	X end angle	Y length/angle	Speed ratio	Probe No.	Cylinder state
Line No.	N						
Line No.	M	X start angle	X end angle	Y length/angle	Speed ratio	Probe No.	Cylinder state
Line No.	J	Jump line No.					
Line No.	E						

Description: J instruction is conditional jump instruction. It must be used in conjunction with M instruction to execute conditional jump; when M instruction detects normal probe signal, the next J jump instruction won't be executed; when probe signal failure is detected, it will execute jump. The jump line number must be M instruction line.

Jump line No.: the line number jumped to when probe detection fails.

Other items of J instruction do not need setting.

6) G instruction: Absolute jump instruction

Instruction format:

Line No.	Instruction	Start X	End X	Wire feeding	Speed ratio	Probe	Cylinder
Line No.	S	X speed		Y speed			
Line No.	L	Number of cycles					
Line No.	M	X start angle	X end angle	Y length/angle	Speed ratio	Probe No.	Cylinder state
Line No.	N						
Line No.	M	X start angle	X end angle	Y length/angle	Speed ratio	Probe No.	Cylinder state
Line No.	G	Jump line No.					
Line No.	E						

Description: G instruction is absolute jump instruction. The absolute jump instruction will be executed and jump to set the line number when the program executes the line. The jump line number must be M instruction line.

Jump line No.: the line number jumped to when executes the jump.

Other items of G instruction do not need setting.

**3.3.2 Examples of M, J, G instructions**

Line No.	M	20	30	20			01	X reaches 20° first, then retracts 1# cylinder and extends out 2# cylinder, 3# and 4# cylinder status remains unchanged, and then interacts with Y-axis. Y-axis speed is the tracking speed. Y-axis feeds 20 mm
Line No.	M	45		100			1011	X reaches 45° first, then retracts 2# cylinder and extends 1#, 3# and 4# cylinder, and Y-axis feeds 100 mm; wire feeding speed is the speed set by S instruction
Line No.	M	30	50	100	0.2	1	1	X reaches 30° at S speed×0.2d, extends 1# cylinder, and then interacts with Y-axis. Y-axis speed is the tracking speed. X-axis rotates to 50°, while Y-axis feeds 100 mm, and checks 1# probe touching; if probe signal is touched during running, the program automatically stops the processing of current line and retracts the cylinder, and goes to the next line to continue; or else retracts the cylinder after executing and then goes to the next line.
Line No.	J	7						Conditional jump instruction is executed; when the previous line has probe check, this instruction is valid, or else it is invalid and the system will automatically skip this line and continue to execute next line; when the previous

								line has probe check, if probe is touched during running, it won't jump but execute in sequence, or else jump to a specific line number 7 and execute. Check if the jump position is reasonable, or else infinite loop of program execution may occur.
Line No.	M	360						X rotates to 360°
Line No.	G	6						Absolute jump instruction; the program executes to this line, it will jump to the specified line number 6 immediately and continue to execute; special processing for springs of probe detection failure can be achieved in conjunction with the J instruction in order to detect waste more easily.
Line No.	M	100	+	100				X-axis runs to 100° at the speed set by S, X-axis and Y-axis perform interpolation jointly, and X-axis is spindle. End angle "+" indicates positive homing, corresponding to 360°; end angle "-" indicates negative homing, corresponding to 0°.
Line No.	M	10		100				Since the previous end angle is "+", when the X-axis rotates to 360°, it will continue to rotate to 10° in the same direction, rather than reverse backwards to 10°. If end angle is null, the spindle switches to Y-axis, and performs uniaxial or interpolation motion at the speed set by Y-axis.

 **Note:**

When entering data, except Y-axis feeding can be negative, other values are greater than or equal to 0. After entry, be sure to store the program in the hard disk in order to avoid loss of data after unexpected power failure. After this process, the system will process according to the latest data automatically in the next process.

### 3.3.3 Program examples

Line No.	Instruction	Start X	End X	Wire feeding	Speed ratio	Probe	Cylinder
00	S	60		50			
01	M	10	20	20			0001
02	M	30		100			
03	M	45	75	50	0.3	1	1
04	J	14					
05	M	90	100	10			
06	L	6					
07	M	120	150	30		2	01
08	J	14					
09	M	180	200	10			
10	N						
11	M	230	300	5			
12	M	360					0000

13	E						
14	M	180	250	200			
15	M	360					0000
16	G	13					

### 3.3.4 Statement explanation

- 00: 00: Set the X axis rotation speed to 60 r/min and Y axis feeding speed to 50 m/min.
- 01: X rotates to 10° first, then retracts 1#, 2# and 3# cylinder, and extends 4# cylinder, then X-axis rotates to 20°, and Y feeds 20 mm.
- 02: X rotates to 30° first, then Y-axis feeds 100mm; the feeding speed is 50 m/min set by S instruction.
- 03: X rotates to 45° at 60×0.3 speed, extends 1# cylinder, and then rotates to 75° at 60×0.3 speed, while Y-axis feeds 50 mm, and checks 1# probe touching; if probe signal is checked, the program automatically stops the processing of current line and retracts 1# cylinder until the next line; or else goes to the next line after executing this line.
- Note: The probe must correlate with the cylinder, 1# probe corresponds to 1# cylinder only, 2# probe corresponds to 2# cylinder only, and so on; for cylinders: The first column indicates 1# cylinder, the second column indicates 2# cylinder, and so on; four cylinders are available. If the column is 1, the cylinder extends when the system reaches the start angle indicated by the line, 0 indicates to retract the cylinder, and null (no data) indicates that the cylinder remains unchanged.
- 04: If probe signal is detected in the course of program execution of line 03, it will continue execution, or else the program jumps to line 14 and continue execution.
- 05: X rotates to 90° first, and then rotates to 100° while Y feeds 10mm.
- 06: Set a loop start flag, and set the number of loops to 6.
- 07: X-axis first rotates to 120°, extends 2# cylinder, and then rotates to 150°, while Y-axis feeds 30 mm, and checks 2# probe touching; if probe signal is checked, the program automatically stops the processing of current line and retracts 2# cylinder until the next line; or else goes to the next line after executing this line.
- 08: If probe signal is detected in the course of program execution of line 07, it will continue execution, or else the program jumps to line 14 and continue execution.
- 09: X-axis first rotates to 180°, and then rotates to 200°, while Y-axis feeds 10mm.
- 10: Set the end flag of one cycle; when the specified number of cycles is equal to the number set by L instruction, line 11 of the program is executed, or else the cycle reverses from line 09 to line 06 and continues execution.
- 11: X-axis first rotates to 230°, and then interacts with Y-axis and runs to 300°, while Y-axis feeds 5mm.
- 12: X-axis runs to 360°, homes, and retracts all cylinders.
- 13: Program ends

- 14: X-axis first runs 180° and then interacts with Y-axis and runs to 250°, while Y-axis feeds 200mm.
- 15: X-axis runs to 360° and homes.
- 16: The program jumps to line 13 so that the program can end.

**Note:**

When editing the data, do not let X-axis rotate a small angle and Y-axis feed a long line, or else the speed of feeding axis will be too fast and cause motor alarm. When input error occurs, the system will prompt invalid data or feeding too long.

### 3.4 System parameters recovery

In actual operation, the data or system parameter on the hard disk may be damaged due to improper operation or unexpected power failure, and may cause system error. This generally does not appear. The system has default parameter correction function and will prompt as below:

“Please update the profile first

Press any key to continue...”

In this case, you can enter the system and choose system parameter editing interface to edit the parameters manually, then save and exit, and restart the controller. System parameter setting interface has system parameter backup and restore function. After system parameter setting, back up the system parameters; in the event of system parameter loss, use the restore function to restore the system parameters. If the error still occurs, please contact the company to seek a solution.

**Note:**

The spring control program is constantly being upgraded, and the manual is subject to change. If you have question about the operation, please contact the company!

Tel: 0755-26722719-378

## Chapter 4 Precautions and Maintenance

### 4.1 Precautions

**Safety information:**

- Do not remove the housing without permission.
- Cut off the power if the controller won't be used for an extended period of time.
- Keep the controller away from dust and iron powder.
- Handle the machine with care to avoid any damage.

**Correct Use:**

- Wrong operation will result in abnormal running. In worst cases, the controller can be damaged.
- So, please follow the instructions below in operating the controller:
- Check all power sources and make sure they are conforming.
- The lifetime of the controller largely hinges on the ambient temperature. If the ambient temperature is too high, please install a cooling fan to dissipate the heat. The allowed temperature range for the controller is 0°C-60°C.
- Do not use the controller in an environment with high temperature, humidity, dust or erosive gas.
- If the controller needs to be operated in a place with violent vibration, an anti-vibration pad should be used.

### 4.2 Maintenance

**Caution:**

- Cut off the power for the main return circuit before maintenance.
- The operator must make sure the power has been disconnected.

**Items to Be Checked and Time:**

Under normal operation conditions (average daily temperature: 30°C, load rate: 80%; running time: 12 hours per day)

Routine Inspection	Routine	<ul style="list-style-type: none"> <li>● Confirm environmental temperature, humidity, dust, or foreign objects.</li> <li>● Confirm abnormal vibration and noise;</li> <li>● Check whether vents are blocked by yarn etc.</li> </ul>
Regular Check	One year	<ul style="list-style-type: none"> <li>● Check whether solid components are loose</li> <li>● Confirm whether terminal block is damaged</li> </ul>

## Chapter 5 Troubleshooting

Common system failures and solutions are described below:

- 1) If the system prompts that “Can’t find the control card!”, the board and card contact may be poor or DIP switch position is wrong; please turn off the machine, open the case, reinsert the card or move the DIP switch to ON position; if the failure still can’t be eliminated, please contact the dealer.
- 2) The system has been started, but all or some of the buttons are unresponsive; the keyboard probably has problem’ please contact the dealer.
- 3) The system has been started, but the screen displays X alarm or Y alarm in cycle, and the servo drive doesn’t display alarm; in this case, check the system wiring; if the wiring has no problem, change the servo parameters to reverse the servo alarm output; for the servo control system that the servo alarm logic can’t be changed, set the alarm logic to reverse it in device parameter setting interface.
- 4) After the system is started, only one direction moves when each axis moves manually, while the other direction vibrates from time to time; in this case, set the control mode of the drive to pulse + direction.
- 5) Axes can be normally driven by the handwheel after the system is started, but the machining can’t be started. In this case, you should first make sure the system is correctly reset. Then check whether there is any broken wire. For some wire feeders that can’t provide broken-wire signal, you should short connect the broken-wire input signal, as it is the NC contact. Besides, you should also check whether the quantity of machined products exceeds the target number.
- 6) The system can be normally started, but reset error appears when the key Reset is pressed. In this case, you should check whether the E-stop button is pressed down. If home failure is displayed after a period of time, check if the input signal of home switch is valid or if the electronic gear setting of servo matches the number of pulses per revolution of the system.
- 7) Probe always fails. Please make sure the set probe delay is long enough, and the machine body and the controller are grounded together.
- 8) Probe always fails. Please make sure the set probe delay is long enough, and the machine body and the controller are grounded together.
- 9) Alarm (controller long beep) appears after the system starts; the processing quantity of springs may exceed the target quantity; you can press “Reset Counter” or enter the parameter setting interface to reset target quantity.

After power on, the controller doesn’t send pulse but the motor runs; in this case, please check the wiring and the connection of ground wire, and set the filter parameters of servo

## Appendix A: Setting of Servo Parameters

All parameters are based on the Sanyo Q series drivers. For other models, please make the corresponding options.

### A.1 System Parameters (RU)

Page	Definition	default	Set Value	Remarks
00	Input power type (3-phase/single-phase)	00	01	00=3-phase 01=single phase
01	Encoder type	00	00	00=incremental 01=absolute value
02	Setting of incremental encoder	00	00	
03	Revolution of incremental encoder	-----	2000	The pulse number fed back for each revolution of the motor. See the documentation of the motor, and normally it is 2000
08	Working mode	-----	02	00=torque mode 01=speed mode 02=position mode 03=speed-torque mode 04=position-torque mode 05=position-speed mode This system adopts the position control mode
09	Selection of position-mode encoder	00	00	00=internal encoder 01-02=external encoder
0B	Selection of brake resistor	-----	00	00=brake-free resistor 01=internal brake resistor 02=external brake resistor

### A.2 Basic Parameters (PA)

#### Group0

Page	Definition	Default	Set Value	Remarks
00	Position loop proportion gain	30	60	Rigidity select options. Increase this value to increase the rigidity of the system and reduce the in-position time.
00	Speed loop proportion gain	50	70	Rigidity select options. Increase this value to increase the rigidity of the system and reduce the in-position time.
0A	Feedforward gain	0	50	Rigidity select options. Increase this value to increase the rigidity of the system and reduce the in-position time.
0C	Acceleration/Deceleration time	0(ms)	0	

## Group1

Page	Definition	Default	Set Value	Remarks
04	Electronic gear ratio	1/1	1/1	1/1=8000 pulses/r (For a 2000-wire motor, you must confirm the number of pulses fed back for each revolution of the motor before you set this value, and make sure the number corresponds to that in the first system parameters))

## Group3

Page	Definition	Default	Set Value	Remarks
00	Pulse filtering	00	02	00: 800ns(1.25MHz) 01: 200ns(5MHz) 02: 400ns (2.5MHz) 03: 1.6us (625KHz) 04: 3.2us(312.5 KHz) 05: 6.4us (156KHz) 06: 100ns (10MHz) 07: 66.7ns (15MHz)
02	Selection for positive/reverse	??	00 or 40	

## Group4

Page	Definition	Default	Set Value	Remarks
00	Pulse selection	00	20	00=pulse/pulse 10=orthogonal pulse 20=pulse/direction This system supports the pulse/direction mode and pulse/pulse mode

## Group8

Page	Definition	Default	Set Value	Remarks
00	Setting of servo ON signal	02	01	Always effective
04	Positive rotation limit	0D	0C	Use CONT6 as NO
05	Reverse rotation limit	0B	0A	Use OONT5 as NO

## Group9

Page	Definition	Default	Set Value	Remarks
07	Setting of servo alarm	39	38	Set the servo alarm switch

**A.3 Alarms (Frequently Used)**

Alarm	Description	Solution
41	Overload, UVW wiring error, or incompatibility between the driver and motor	Reduce load, change UVW wiring, or change the motor type of the driver
43	Brake resistor error	Check setting and wiring of the brake resistor
61	Power	Check the power supply
85	Encoder error	Check the wiring of the encoder
D2	Error of pulse frequency of positioning instruction	Check the pulse-filtering parameter at Page 00 of Group 3

**Appendix B: Version Upgrade Instruction**

The appendix describes the additional features for product upgrade.

**B.1 Description of additional features of version upgrade**

Table B.1 List of Additional Features of Version Upgrade

Additional features	Description	Reference entry